Students should be able to:
• Solve problems involving the definition of momentum
• Solve problems involving the definition of impulse
• Solve problems involving the relationship between momentum and impulse
• Solve problems involving elastic collision in 1 dimension
• Solve problems involving inelastic collision in 1 dimension
• Solve problems involving elastic collision in 2 dimensions
• Solve problems involving inelastic collision in 2 dimensions
• Solve problems involving the conservation of momentum and the conservation of kinetic energy
• Solve problems involving recoil

A
\[ V = 5 \text{ m/s} \]

Impulse: ____________
Momentum of the bike: ____________
Momentum of the rider: ____________

B
\[ V_0 = 30 \text{ m/s} \]
\[ m = 0.150 \text{ kg} \]
Calvin catches the

C
\[ V_0 = 20 \text{ m/s} \]
\[ m = 0.150 \]
\[ V = 35 \text{ m/s} \]
Line drive - straight

D
\[ V_0 = 10 \text{ m/s} \]
\[ m = 0.1 \]
The snow ball hits Susie on the head and
1

BEFORE

\[ V_A = 10 \text{ m/s} \]

\[ V_B = 2 \text{ m/s} \]

\[ M_A = 1000 \text{ kg} \]

\[ M_B = 2000 \text{ kg} \]

A

B

DOINK

AFTER

\[ V_A' = ? \]

\[ V_B' = 5 \text{ m/s} \]

\[ M_A = 1000 \text{ kg} \]

\[ M_B = 2000 \text{ kg} \]

A

B

2

BEFORE

\[ V_A = ? \text{ m/s} \]

\[ V_B = 3 \text{ m/s} \]

\[ M_A = 1000 \text{ kg} \]

\[ M_B = 2000 \text{ kg} \]

A

B

CRUNCH

AFTER

\[ V_A' = 3 \text{ m/s} \]

\[ V_B' = 8 \text{ m/s} \]

\[ M_A = 1000 \text{ kg} \]

\[ M_B = 2000 \text{ kg} \]

A

B
3

**BEFORE**

\[ V_A = \text{? m/s} \quad V_B = 3 \text{ m/s} \]

\[ M_A = 1000 \text{ kg} \quad M_B = 2000 \text{ kg} \]

**AFTER**

\[ V = 5 \text{ m/s} \]

\[ M_A = 1000 \text{ kg} \quad M_B = 2000 \text{ kg} \]

STICK TOGETHER

---

4

**BEFORE**

\[ V = 5 \text{ m/s} \]

\[ M_R = 60 \text{ kg} \quad M_B = 20 \text{ kg} \]

**AFTER**

\[ V_R' = 1 \text{ m/s} \]

\[ V_B' = \text{? m/s} \]

\[ M_R = 60 \text{ kg} \quad M_B = 20 \text{ kg} \]
Hobbes, the stuffed tiger, has a mass of 31.8 kg. Calvin, the little boy, has a mass of 25.1 kg. In a game of football, Hobbes runs at Calvin at 11 m/s. Calvin is running in the same direction as Hobbes, away from Hobbes, at 8.33 m/s.
(a) If the two collide and stick together, what is their final velocity?
(b) What impulse is exerted on Hobbes by Calvin?
(c) What impulse is exerted on Calvin by Hobbes?
(d) If the collision occurred in 0.109 seconds, Then what force was exerted on Hobbes?

Hobbes, the stuffed tiger, has a mass of 31.8 kg. Calvin, the little boy, has a mass of 25.1 kg. In a game of football, Hobbes runs at Calvin at 7.22 m/s. Calvin is running at Hobbes.
(a) If the two collide, stick together, and are then at rest, what was Calvin's initial velocity?
(b) What impulse is exerted on Hobbes by Calvin?
(c) What impulse is exerted on Calvin by Hobbes?
(d) If the collision occurred in 0.0600 seconds, Then what force was exerted on Hobbes?
\( m_A = 1 \text{ kg} \)

\[ \begin{align*}
A & \quad \text{2 m/s} \\
B & \quad \text{REST} \\
A & \quad m_B = 0.5 \text{ kg} \\
A & \quad V_A = ? \\
B & \quad V_B = ?
\end{align*} \]
$m_A = 1 \text{ kg}$

$A$

4 m/s

$B$

REST

$m_B = 2 \text{ kg}$

$A$

$V_A = ?$

$B$

$V_B = ?$

15°

18°
\[ m_A = 2 \text{ kg} \]

\[ m_B = 1 \text{ kg} \]

\[ V_A = ? \]

\[ V_B = ? \]
1] m_A = 3 kg

m_B = 2 kg

V_A = ?

V_B = ?

A

B

REST

B

50°

20°